CASE STUDY - Wiring	
TASK TITLE: Wiring	
Task Description:	There are two basic types of wiring tasks. The first task involves securing two or more objects by twisting or crimping them together. Often the employee will precut the amount of wire from a roll before joining the objects. It is also possible that the employee will have to remove the insulation (coating) from the wire once the task is completed. The tools most commonly used are pliers (e.g., needle-nose) and wire strippers and cutters. The second type of wiring occurs when electrical wires or pneumatic hoses are threaded or pushed between two structures. This commonly occurs when offices/automobiles/appliances are being repaired. Here, the wire can be either precut, or pulled from a roll. The most common tool used is pliers. In both cases, the location of the wiring task can vary tremendously, thus, this task can be performed while standing or sitting. Typical jobs in which wiring is performed include (but not necessarily limited to): • automobile maintenance • HVAC system maintenance • facility maintenance • radio maintenance
Job Performance Measures Most Often Impacted by Wiring:	• Time to completion • Integrity of wiring system (e.g., does it work)
Typical Employee Comments about Wiring:	The most common complaint from employees is discomfort and/or stiffness in the shoulders/neck and hands/wrists. The primary body parts affected are typically: hands/wrists/arms and shoulders/neck. The secondary body parts affected are typically: back/torso and legs/feet.
Suggested Level II Analysis:	Postural Task Analysis, Dynamic Task Analysis, Grip Force Measurement, Elemental Task Analysis, Light Measurement

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Repeated reaching or arms held away from body while unsupported	• Work location too high	123. Raise the person • provide a step stool/ladder • provide a platform or scaffold	✓	✓ ✓	med med	med low	med med
		112. Provide support for the arms • rest arms on near-by surfaces • provide flexible arm rests that can be attached to nearby surfaces.	✓	✓	low med	low low	med med
	• The work piece must be manually supported or held	118. Provide support for the work piece • provide a clamp for stabilizing or holding back any surrounding wires.	✓	✓	med	med	med
	• Work location is too far away (see Figure 1.1)  **Figure 1.1**	38. Move closer to the work location • remove obstructions • remove additional access panels	✓ ✓		low low	low low	low low

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
2. Arm forces exceeding 10 lb.	• Interference or "hang up" when pulling wires	140. Use alternative fasteners • use fish tape and pull wires with two hands	✓		low	med	med
		• clear hang-up prior to pull	✓		low	med	med
	• Many rolls of wire must be transported from one area to another	48. Provide a cart • provide a cart which mounts the spools horizontally and feeds the wire via rollers to a nozzle		✓	med	med	med
3. High speed, sudden shoulder movements	• The wire must be pulled / yanked to be joined	128. Reduce force required to install or remove the component • provide rollers at the wire roll and at the top and bottom edges of the openings to decrease frictional forces		✓	med	med	med

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• The wire must be pulled / yanked through the insulation	128. Reduce force required to install or remove the component • coat the wire with soapy water to decrease the friction required	✓		low	med	med
4. Head/neck bent or twisted	• Work location too low (see Figure 1.2)  **Figure 1.2**	31. Lower the person • provide a chair or stool for the employee to sit on	✓	✓	med	med	med
	• Work location too high	123. Raise the person • provide a step stool/ladder • provide a platform or scaffold	✓	✓ ✓	med med	med med	med med

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Quality must be visually inspected	22. Increase light levels • provide task lighting which is easy to adjust - provide task lighting that allows for 20-25 foot-candles (200-250 lux).		✓	med	med	med
		60. Provide a magnifying glass • provide a stand supported magnifying glass that has a built in light		✓	med	med	med
		136. Rotate the work piece • rotate the piece manually • provide a fixture to allow the work piece to be rotated	✓	✓	low med	med med	low med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
5. Bent wrists/repeated wrist movements or repeated forearm rotation	• The type of tool used is not appropriate for the twisting/crimping required.	76. Provide a tool which requires minimal force to use • Provide an appropriate tool that allows for crimping and quick twisting		✓	med	med	med
		• crimp instead of using twist wires	✓		low	med	med
	• There is a large amount of insulation to be removed	34. Maintain hand tools/power tools	✓		low	low	med
		• provide tools which have sharp cutting edges and aligned jaws		✓	med	low	med
		• provide stripping tools which strip wire as pliers are closed.		✓	med	low	high
		• provide automatic wire stripper; pre-strip wires.					
	• Work surface is too high or too far away	123. Raise the person • provide a step stool	✓	✓	med	med	med
6. Repeated manipulations with fingers	• Repetitive nature of the work task • Unscrewing and tightening of terminal leads	20. Incorporate rest breaks	✓		low	low	low

Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
7. Hyperextension of finger/thumb or repeated single finger activation	• Pliers do not have a spring-loaded handle	91. Provide an appropriate tool • provide a tool that has a self-opening spring between the handles		✓	med	low	med
		66. Provide a power tool		✓	med	med	med
8. Hand/grip forces	• Wires or bundles must be held and manipulated.	118. Provide support for the work piece • provide a clamp that secures the work object or holds back wires during task	✓		low	low	med
	• The wire must be pulled / yanked through the pieces to be joined	128. Reduce force required to install or remove the component • provide rollers at the wire roll and at the top and bottom edges of the openings to decrease frictional forces and "hang-up"		✓	med	low	med
		• coat the wire with soapy water to decrease the friction required	✓		low	low	low
	• The tool used for twisting/crimping requires high grip forces.	76. Provide a tool which requires minimal force to use • provide an appropriate tool that allows for crimping and quick twisting		✓	med	med	med
		• provide a power crimping tool		✓	med to high	med	med

Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
9. High speed hand/wrist/arm movements or vibration, impact, or torque to the hand	• Rarely occurs	N/A					
10. Exposure to hard edges	• Tool handle has hard edges	9. Eliminate exposure to hard edges • provide a tool with a round, smooth handle with no ridges or edges		✓	med	med	med
		• provide a handle of at least 5" in length	✓	✓	med low	med med	med med
		• wrap the tool handles					
	• Work station has hard or sharp edges (see Figure 1.3)	9. Eliminate exposure to hard edges • provide padding for edges	✓		low	med	med

Figure 1.3

Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
11. Hands and fingers exposed to cold temperatures	• Work area is too cold	93. Provide appropriate gloves	✓		low	med	med
		105. Provide portable heaters		✓	med	med	med
		110. Provide shields or barriers from the wind		✓	med	med	med

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
12. Repeated forward or sideways bending movements	• Rarely occurs	N/A					
13. Twisting of the lower back	• Work space is cramped or access is limited (see Figure 1.4)  **Figure 1.4**	63. Provide a padded, compressible surface to lay on • provide a pad/mat 117. Provide support for the upper body	✓	 ✓	 low med	 med med	 med med
14. High speed, sudden movements	• Rarely occurs	N/A					

Back/Torso (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
15. Static, awkward back postures	• Inadequate lower back support while seated • Inappropriate chair adjustment. • Inappropriate chair design	115. Provide support for the lower back					
		• adjust back rest to support lower back	✓		low	med	med
		• pull chair forward and lean back while working	✓		low	med	med
		• attach a small pillow to back rest to support lower back	✓		low	med	med
		• provide a chair with adequate lower back support		✓	med	med	med
	• Work location is too low • Work location is too far away	31. Lower the person					
		• provide a chair or stool	✓	✓	med	med	med
		38. Move closer to the work location					
		• remove obstructions	✓		low	med	med
		136. Rotate the work piece					
		• provide a fixture to allow the work piece to be rotated		✓	med	med	med

Back/Torso (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Quality must be visually inspected	22. Increase light levels • provide task lighting which is easy to adjust		✓	med	med	med
16. Lifting forces	• Rarely occurs (if it occurs, see Lifting case study)	N/A					
17. Pushing or pulling	• Many rolls of wire must be transported from one area to another	48. Provide a cart • provide a cart which mounts the spools horizontally and feeds the wire via rollers to a nozzle		✓	med	low	med
18. Whole body vibration	• Rarely occurs	N/A					

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Fixed position, standing	• Standing surface is hard	52. Provide a footrail	✓	✓	med	low	med
		86. Provide appropriate anti-fatigue mat		✓	med	low	med
		96. Provide appropriate shoe inserts	✓		low	low	med
20. Exposure to hard edges on legs, knees, and feet	• Work station has hard or sharp edges	9. Eliminate exposure to hard edges • lay a blanket or cushion over hard edges	✓		low	med	med
21. Awkward leg postures	• Work surface is too low (kneeling)	31. Lower the person • provide a low stool	✓	✓	med	low	med
		95. Provide appropriate knee protection • if kneeling is required.	✓		low	low	med
22. Standing foot pedal	• Rarely occurs	N/A					

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
23. Difficult to see/light levels too low/too high	• Glare directly from a light source: looking towards an overhead light • Glare from an overhead light reflected off equipment or worksurface.	109. Provide protection from glare from overhead lights/task lights • position work between overhead lights. • remove glossy or shiny surfaces from work area • place the work station so that it faces a wall or partition. • install parabolic louvers to direct light down on the surface.	✓ ✓ ✓	 ✓ ✓	 low low med high	 med med med med	 med med med med
	• Glare directly from a light source: looking towards an uncovered window • Glare from an uncovered window reflected off equipment or worksurface.	108. Provide protection from glare from natural light • orient work station so that the person faces perpendicular to the window. • adjust window coverings • provide window coverings	✓ ✓	 ✓	 low low med to high	 med med med	 med med med
	• Glare directly from a light source: looking towards a task light • Glare from a task light reflected off equipment or worksurface.	109. Provide protection from glare from overhead lights/task lights • adjust the task light to reduce glare. • turn off the task light. • shield task light to prevent it from shining into eyes.	✓ ✓	 ✓	 low low low to med	 med med med	 med med med

Head/Eyes (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Light levels too high.	27. Lower the light levels • remove pairs of fluorescent light bulbs from overhead fixtures. Note: this should be done with the appropriate technical assistance and the agreement of co-workers in the area.		✓	low to med	med	med
	• Light levels too low:	22. Increase light levels					
		• provide task light		✓	med	med	med
		• increase overall light levels to meet the needs of tasks		✓	med	med	med
	• Uncorrected visual disorders cause the person to lean forward to see work	14. Encourage person to have visual disorders corrected	✓		low	med	med
	• Text too small to read. • Text is difficult to read (poor quality)	18. Improve visual access to work					
		• increase size of text	✓	✓	med	med	med
		• increase the legibility of text	✓	✓	med	med	med
24. Intensive visual tasks, staring at work objects for long periods	• Length of work task without a change of position for the eyes.	8. Distribute intensive activities throughout the process • perform intensive visual tasks for short periods throughout the day (as opposed to in one continuous session).	✓		low	med	med

Head/Eyes (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		20. Incorporate rest pauses • periodically look away from screen.	✓		low	med	med